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# **A Study of the Components of Air in Relation to Animal Life**

Abstract of Papers, 42 (1924), 51 (1925), 25 (1926), 17a (1927) and 21 & 22 (1928).

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Oxygen, since the time of Lavoisier, has been considered the vital component of the air. The 79.19 per cent inert part has had little use assigned to it. Popular opinion had stated that animal life would be more efficient if these inert gases were replaced by oxygen.

Carefully conducted experiments, covering a period of six years, have shown the following truths in regard to animal life and the components of the air.

Animals can not live in an atmosphere alone of oxygen, nitrogen, carbon-dioxide, helium, or argon. A series of thirty experiments, using representative varieties of animal life, has shown that in an atmosphere of pure oxygen, with other conditions normal, life would cease after two to five days. In no case did any of the animals live over a week in oxygen, while in the current of air we had them confined from one to three weeks without any signs of ailments. With the animals such as sparrows, pigeons, mice, rats, cats, guinea pigs, and monkeys, without a single exception, every one died in oxygen and none in air. As could be expected, the inert gases would not support life.

## **Autopsy Shows Hemorrhage**

An examination of the lung tissue from a guinea pig, which had died in an atmosphere of pure oxygen, showed marked evidences of inflammation and interstitial hemorrhage.

Cultures made from lung tissue showed a heavy infection of *Bacillus coli* associated with a few *Staphylococci*. The conclusion drawn from the autopsy was that an atmosphere of oxygen would not only rupture the lung tissue but accelerate the growth of certain micro-organisms.

## **Carbon-dioxide and Oxygen**

Animals were placed in an atmosphere of 99.97 per cent oxygen and the normal .03 per cent carbon-dioxide. The animals used for this series of experiments were guinea pigs. Death followed within two days to five days as in the oxygen experiments.

## **The Effect of Pure Oxygen upon Water Animals**

The experiments were continued with water animals in pure oxygen which was passed continually through the water. The animals for these experiments were fish, tad-poles, snails, newts, and turtles. These water animals tested just the opposite from the land animals. In this case the pure oxygen could not have had such a burning effect when diluted with water which also soon became saturated with carbon-dioxide.

### Argon and Oxygen Atmosphere

An atmosphere was prepared which contained 87 per cent argon and 13 per cent oxygen. Mice lived forty-two hours under this condition. The respiration of the animals decreased slowly until death.

Argon 80 per cent and oxygen 20 per cent permitted life for ninety-two hours.

Argon 75 per cent and oxygen 25 per cent permitted normal life. After ten days of confinement the animals appeared in better health than before the experiment.

An atmosphere made up of 66 2-3 per cent argon and 33 1-3 per cent oxygen supported life. The animals after seven days confinement were in poor health. The point of highest efficiency had apparently been passed.

### Helium Atmosphere

Helium 79 per cent and oxygen 21 per cent form an atmosphere under which animal life may exist normally.

The high specific gravity, 1.38 (air), of argon gas probably accounts for its behaviour as an oxygen diluting agent. Experiments must be carried further before a scientific conclusion can be reached.

The preparation of synthetic atmosphere has practical applications in the field of aviation. Tubes of compressed oxygen and helium may some day furnish the respiration gases for high flying.

The study of the physiological effects of the air gases has only begun. We are continuing the experiments here on the components of the air for further information along this same line.